Tutorial

ASSIGN BUSTER

FE1002 PHYSIC 2 Tutorial 1– [optic] 2007/2008 Semester 2 FE1002 Physic 2 Tutorial 1 – Optic QUESTION 1: light with a wavelength of 700nm is incident on the face of a fused quartz prism (n = 1. 46 at 700nm)at an angle of 75? (with respect to the normal to the surface). The apex angle of the prism is 60. 0?. Calculate the a) b) c) d) angle of refraction at this first interface angle of incident at this second interface angle of refraction at the second interface and angle between the incident and emerging rays. 1= n2sin 2. Hint: Use Snell's law n1sin Solution: a) n1sin 1= n2sin 2. 60 4) total angle inside a rectangular = 360? 60? +60? + (90? +41. 4?)+(90? + 3)= 3 60? c) 1. 46sin18. 6 = 1sin d) 5= 4 75 (75? 2)+(43) 3 2 QUESTION 2: a) A glass fiber (n= 1. 50) is submerged in water (n = 1. 33). what is the critical angle for light to stay inside the optical fiber? Hint: For light to stay within the optical fibre, it must be incident on the air-glass interface at angle greater than the critical angle. Use Snell's law n1sin 1= n2 sin 2 with 2 = 90?. Solution: 1. 50sin 2= 1. 31 b) Determine the maximum angle for which the light rays incident on the end of the pipe shown in the Figure.

Are subject to total internal reflection along the walls of the pipe. Assume that the pipe has total internal reflection of 1. 36 and the outside medium is water. Hint: Apply Snell's law to the entrance end of the fibre . Done by Foo Boon Kiat (com) Page 1 FE1002 PHYSIC 2 Tutorial 1– [optic] 2007/2008 Semester 2 • Solution: c i 2 c 1. 36 sin c = 1 sin 90? 2 Then using a right angle triangle, 90? = 42. 7? Then 1. 0sin i= 1. 36sin 2 which is the refraction rays is equal to 180? - c- ? QUESTION 3: A narrow beam of white light is incident at 25? to the normal of heavy flint glass 5. 0 cm thick.

The indices of refraction of the glass at wavelength of 400nm and 700nm are 1. 689 and 1. 642, respectively. Find the width of the visible beam as it emerges from the slab. Hint: Since n is different for different wavelength, the angles of refraction for the two wavelengths will also differ. Apply Snell’s law to both wavelengths. Solution: 25? o a1 a2 5cm 25? For ray 1(n= 1. 689), the refraction angle is 14. 49? while the ray 2(n= 1. 642) is 14. 92? Done by Foo Boon Kiat (com) Page 2 FE1002 PHYSIC 2 Tutorial 1– [optic] 2007/2008 Semester 2 The difference of distance between ray 1 and ray 2.

Using right angle triangle. QUESTION4: A fish is in a depth d under water. Take the index of refraction of water as 4/3. Show that when the fish is viewed at an angle of refraction 1, the apparent depth z of the . fish is z= Hint: Using equal side triangle, the z ratio of z and d can b found. X D R z z X r 1 d 2 Solution: z = rcos X= rsin 1= Rsin 2 1 and d= Rcos 2 Snell’s law, 1sin = 1= 4/3sin 2 = QUESTION 5: The height of the real image by a concave mirror is four times the object height when the object is 30. 0cm in front the mirror . a)What is the radius of curvature of the mirror?) Use a ray diagram to locate this image. Hint: magnification = image height/ object height. Done by Foo Boon Kiat (com) Page 3 FE1002 PHYSIC 2 Tutorial 1– [optic] 2007/2008 Semester 2 Solution: a) mirror equation. Then v= 4(30) where 30is object distance. f= 24. and radius of curvature is 2r= 48cm. b) object image f QUESTION6: A transparent photographic slide is placed in front of a converging lens with a focal length of 2. 44cm. The lens forms an image of the slide 12. 9cm from the slide. How far is the lens from the slide if the image is a)real b)virtual.

Hint: using mirror equation and solve for the distance object from the lens , p. Solution: for case a) The image is real which mean behind the lens, hence . for case b)the image is in front of the lens, q is negative. . p = negative value is rejected because p must be in front of the lens. QUESTION 6: Two rays travelling parallel to the principle axis strike a large plano-convex lens having a refractive index of 1. 60. if the convex face is spherical, a ray near the edge does not pass though the focal point and spherical aberration is said to have occurred. If this face has a radius of curvature, r , of magnitude 20. cm and the two rays are h1 = 0. 5cm and h2= 12. 0cm from the principle axis, find the difference in positions where they cross the principle axis. Hint: Ray h1 is undeviated at the plane surface, and strikes the 2nd surface at the angle of incident, Solution: By using Snell’s law, 1 sin = 1. 6sin It crosses the axis at a point further out by f1 Do the same for f2 and get x2 = 12. 0cm. Hence = 33. 3-12. 0 Done by Foo Boon Kiat (com) Page 4 FE1002 PHYSIC 2 Tutorial 1– [optic] 2007/2008 Semester 2 h2 h1 ? 2 ? 1 Done by Foo Boon Kiat (com) Page 5